ELSEVIER

Brachytherapy 12 (2013) 50–55

BRACHYTHERAPY

Urethral strictures following high-dose-rate brachytherapy for prostate cancer: Analysis of risk factors

Benjamin R. Hindson[1,2,*], Jeremy L. Millar[1,3], Bronwyn Matheson[1,2]

[1]*William Buckland Radiation Oncology, Alfred Health, Melbourne, Victoria, Australia*
[2]*Department of Surgery, Monash University, Melbourne, Victoria, Australia*
[3]*Department of Epidemiology and Preventative Medicine, Monash University, Melbourne, Victoria, Australia*

ABSTRACT

PURPOSE: High-dose-rate brachytherapy is an established technique to deliver a conformal dose of radiation to patients with prostate cancer. The William Buckland Radiotherapy Center has been performing high-dose-rate brachytherapy with external beam radiation treatment for prostate cancer since 1998 and has an extensive prospective database on all patients treated. The purpose of this analysis was to assess the risk of stricture formation and identify the predictive or causative factors.
METHODS AND MATERIALS: Three hundred fifty-four patients were treated between 1998 and 2008. Patients received one of three differing dose schedules: 20 Gy in four treatments (20 Gy/4), 18 Gy/3, and 19 Gy/2 during three sequential time periods. Nelson–Aalen cumulative hazard modeling was used to estimate risk of events over time. Potential risk factors, including dose, were identified and used in the analysis.
RESULTS: There were 45 patients who developed at least one stricture, an overall risk of 8.2% at 2 years. The 2-year risk of stricture formation was 3.4%, 2.3%, and 31.6% for 18 Gy/3, 20 Gy/4, and 19 Gy/2, respectively. Most strictures occurred in the bulbomembranous urethra (50%) or external sphincter region (33%). On multivariable analysis, the dose schedule used was the only significant predictor for increased stricture formation.
CONCLUSIONS: In our patients, those who received 19 Gy/2 were at a significantly higher risk of stricture formation. Most of these strictures were mild, requiring only one intervention but a 2-year stricture risk of 31.6% was striking, and we have modified our protocol. © 2013 American Brachytherapy Society. Published by Elsevier Inc. All rights reserved.

Keywords: Prostate cancer; High-dose-rate brachytherapy; Urethral stricture; Late toxicity

Introduction

Local disease control in intermediate- and high-risk localized prostate cancer has been shown to have a dose response (1–3) but at a cost of increased normal tissue toxicity (4, 5). High-dose-rate brachytherapy (HDRB) in combination with external beam radiotherapy (EBRT) is an established dose escalation technique and offers outcomes at least comparable with EBRT-only studies (6–8). HDRB in combination with EBRT has many advantages: it is more conformal than EBRT alone, the high dose per fraction exploits a postulated low α/β ratio of prostate cancer, and it reduces the overall treatment time. The optimal dose schedule for HDRB in combination with EBRT is yet to be established, but the dose per fraction has been increased to attempt to improve disease cure, reduce in-hospital time, and minimize discomfort for the patient. On the other hand, side effects may also occur as a result of such changes to the dose schedule. For example, the high dose per fraction may also increase the risk of late urethral toxicity. HDRB allows avoidance of structures outside the prostate gland, but the dose is difficult to limit and conform around the urethra, without reducing the prostate dose. The purpose of this analysis was to identify the stricture rate for patients over time; describe the strictures observed; and to identify any factor, including dose delivered, that may be contributing to stricture risk.

Received 7 December 2011; received in revised form 16 February 2012; accepted 13 March 2012.

Conflict of interest: None.

The research was undertaken at William Buckland Radiation Oncology, Alfred Health, Melbourne, Victoria, Australia.

* Corresponding author. William Buckland Radiation Oncology, Alfred Health, 55 Commercial Road, Melbourne, Victoria 3004, Australia. Tel.: +61-3-9076-2337; fax: +61-3-9076-2916.

E-mail address: Ben.hindson@wbrc.org.au (B.R. Hindson).

1538-4721/$ - see front matter © 2013 American Brachytherapy Society. Published by Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.brachy.2012.03.004

Patients and methods

We report on consecutive patients treated as part of a curative regimen that included EBRT and HDRB, from the commencement of our program in November 1998 until November 2008. All but 31 patients (8.8%) received concurrent hormone manipulation. Most patients were at intermediate or high risk (T category higher than T2a or prostate-specific antigen level higher than 10 ng/mL or Gleason score more than 6). Table 1 describes the patient characteristics.

External beam radiotherapy

Fourteen patients received the EBRT component at another center, for geographic reasons. The dose and fractionation for these patients is documented but the technique specifics were not. Ninety-six patients received the HDRB before the EBRT and 258 received HDRB after EBRT, depending on departmental logistics and theater list availability.

The clinical target volume was the prostate only, with departmental protocol margins added to create a planning target volume. For the patients treated at the William Buckland Radiotherapy Center, a three-dimensional conformal technique was used. No attempt was made to treat the pelvic lymph nodes. The most common dose prescription was 46 Gy in 23 fractions (46 Gy/23), delivering 10 fractions daily for a fortnight, prescribed at the International Commission on Radiation Units and Measurements prescription point, using 18 MV photons. Patients were given instructions to have an empty rectum and ''comfortably'' full bladder for the treatment. Gold fiducial markers were used with a daily image-guided setup protocol since 2007.

Table 1
Disease characteristics

Age mean (range)	65 (46–84)
Mean PSA (range)	14.90 (1.0–77.7)
PSA group	*N* (%)
≤10	147 (41.5)
>10–20	135 (38.2)
>20	72 (20.3)
T stage	*N* (%)
<T2	64 (18.0)
T2a	71 (20.1)
T2b	60 (17.0)
T2c	66 (18.6)
T2x	1 (0.3)
T3a	62 (17.5)
T3b	29 (8.2)
T4	1 (0.3)
Gleason score	*N* (%)
<7	90 (26)
7	193 (54.5)
>7	69 (19.5)
NCCN risk group	*N* (%)
Low	9 (2.5)
Intermediate	230 (65.0)
High	115 (32.5)
Median followup	Mo (range)
Overall	59 (5–121)
20 Gy/4	103 (18–121)
18 Gy/3	67 (5–109)
19 Gy/2	21 (7–37)
16 Gy/2	40 (33–47)

PSA = prostate-specific antigen; NCCN = National Comprehensive Cancer Network.

High-dose-rate brachytherapy

In all patients, the HDRB was used as a ''boost'' in combination with EBRT. Since initiation of the HDRB program, three progressive, escalated fractionation schedules were used. From November 1998 to August 2000 a schedule of 20 Gy/4 was used. From September 2000 to June 2006, the schedule changed to 18 Gy/3. From July 2006 until November 2008, 19 Gy/2 was the standard. Two patients planned to receive 18 Gy/3, but received one fraction of 6 Gy and a second fraction of 10 Gy (16 Gy/2). This was because of the delays on Day 2, preventing a third fraction being delivered in a timely fashion.

The technique has been previously described (8). Up until July 2006, metal needles were used. Subsequently, plastic catheters were used in an attempt to reduce trauma. These needles or catheters were placed transperineally using transrectal ultrasound and fluoroscopic imaging for guidance. The needles or catheters were placed within the bladder lumen to ensure adequate coverage of the prostate base. Before September 2005, replanning was not routine. Since then, patients were re-CT imaged on the simulator CT but only replanned if the needle movement was estimated to be greater than 1 cm in the caudal direction. Since August 2008, all patients were replanned for each fraction.

The identification of the apex in the planning images is essential to ensure adequate coverage of the prostate. Before September 2005, this was identified based on the planning CT images. Since September 2005, a fiducial marker has been placed at the apex under ultrasound guidance and used as a reference to improve the identification of the apex on the planning CT images.

The target volume for the HDR component was the prostate with up to 6 mm in the cranial–caudal direction to account for microscopic extension and potential needle movement. Patients were planned using Plato (Nucletron, Veenendaal, The Netherlands) planning software until October 2009, since when the Nucletron Oncentra (Nucletron) planning system was routinely used.

All fractions were given over one admission, at least 6 h apart. The HDRB was delivered by ^{192}Ir source automatically afterloaded with a microSelectron ^{192}Ir (Nucletron). As the prescribed dose changed over time, the dose to the urethra was limited so that no more than 10% of the urethral volume was to receive greater than 120% of the prescribed dose ($D_{10} \leq 120\%$). The consequence of this is that the

Download English Version:

https://daneshyari.com/en/article/6189845

Download Persian Version:

https://daneshyari.com/article/6189845

Daneshyari.com